

$K_L \rightarrow \pi^\pm e^\mp \nu e^+ e^-$  (Ke3ee)

Updates

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- Bug about run composition
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- Uncertainty from radiative events
- Uncertainty from pion loss in TRD
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# Run composition

I called 'KTSPILL(1, **MCMSKBDSP**) in MC generator  
for Ke3ee

**MCMSKBDSP** is a common variable to specify  
which Badspill is not generated.

It should be given as a constant number

But ... **MCMSKBDSP** was overwritten in every  
event in this case.

# Changing Badspill cut

#	description	Last mtg	This time
1	Trigger	On	On
2	Pedestal exp > 0	On	On
3	Bad DPMT capacitor	Off	On
4	Blown comparator	On	On
5	dead DPMT	On	On
7	Gain drift	On	On
8	Broken dynode	On	On
9	Pipe problem	On	On
10	Global Csl problem	On	On
11	Etotal	On	On
13	DC	On	On
14	Veto	On	On
15	V-bank	On	On

#	description	Last mtg	This time
17	HCC	On	On
18	Fruit	On	On
21	DAQ, L3	On	On
22	Not 799 run	On	On
23	Short run	On	On
29	Beam	On	On
19	TRD trigger	On	On
24	Non-standard TRD HV	On	Off
25	1 dead TRD plane	On	On
26	Few dead TRD planes	On	On
27	TRD voltage sag	On	Off
28	Severe TRD problem	On	On

# Effects of changes

	Last meeting	After changes
# of ke3ee (data)	19466	20225
Acceptance of ke3ee	0.5011%	0.5096%
# of norm,pmzd(data)	300526	312707
Acceptance of pmzd	0.4224%	0.4947%
BG ratio	4.96%	4.61%
BR(Ke3ee)	$1.606 \times 10^{-5}$	$1.848 \times 10^{-5}$
K flux	$1.683 \times 10^{11}$	$1.534 \times 10^{11}$
Def. of K flux	with Badspill	w/o Badspill

# The # of photon event

Defect in  
last meeting

$(38 \pm 8)\%$

$(18 \pm 6)\%$

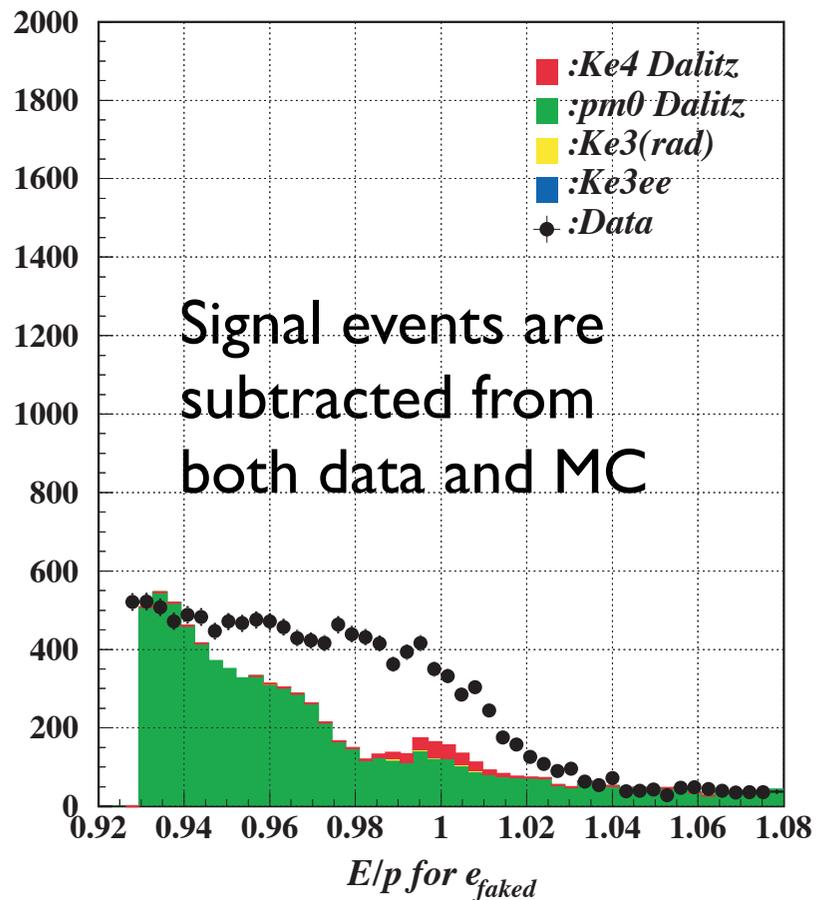
$(6 \pm 8)\%$

After fixed problem  
on bud spill rejection

Correction on  
 $\pi$ -e fake ratio

# One more correction on $\pi$ -e fake ratio

E/p of  $\pi$  faking electron  
around E/p=1

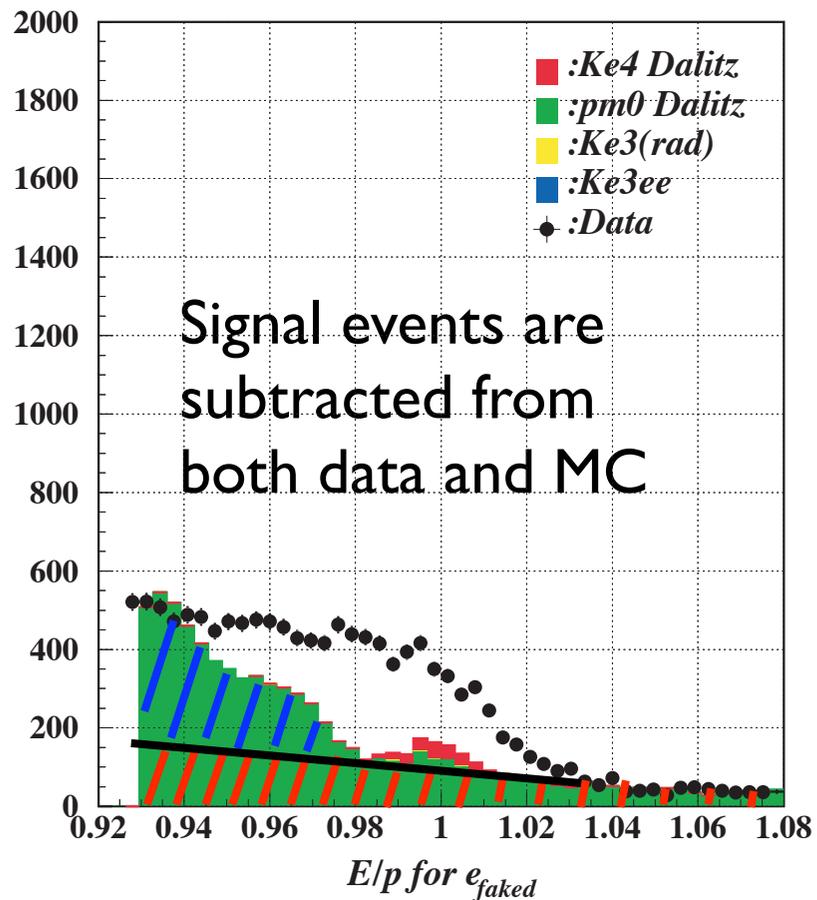


Measured correction factor for lacking background from  $\pi^+\pi^-\pi^0$  event is 1.7, but ...

(Green area)  $\times$  (1.7-1) = (white area)  
This is OK for total BG estimation,  
but ....

# One more correction on $\pi$ -e fake ratio

$E/p$  of  $\pi$  faking electron  
around  $E/p=1$

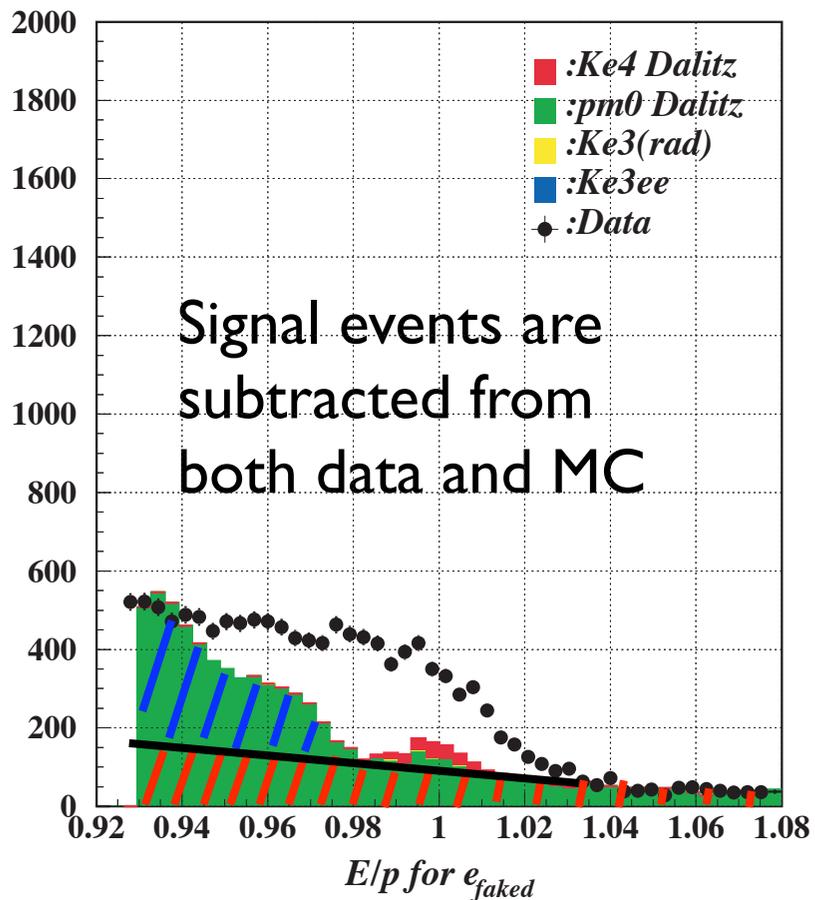


A pion has two ways to fake an electron

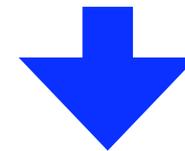
1. Hadron shower (blue stripe).
2. A photon overlaps on the pion cluster (red stripe).

# One more correction on $\pi$ -e fake ratio

E/p of  $\pi$  faking electron  
around E/p=1



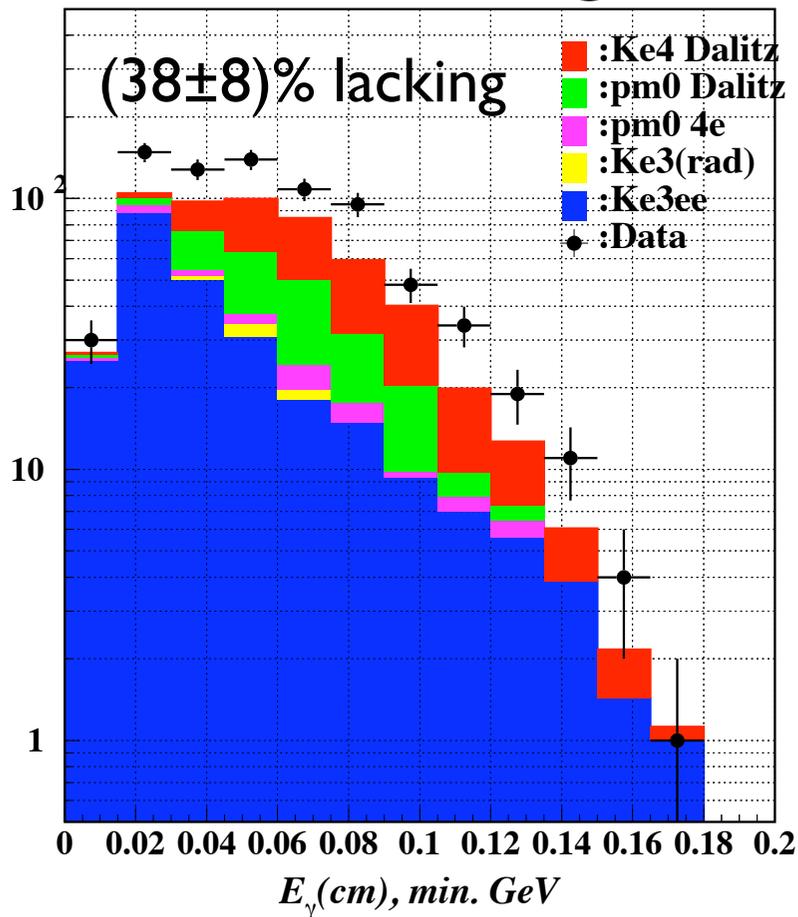
1. It is difficult for overlapping events to be identified as the events which have a photon.
2. A lack of pi-e fake events only results from shower events.



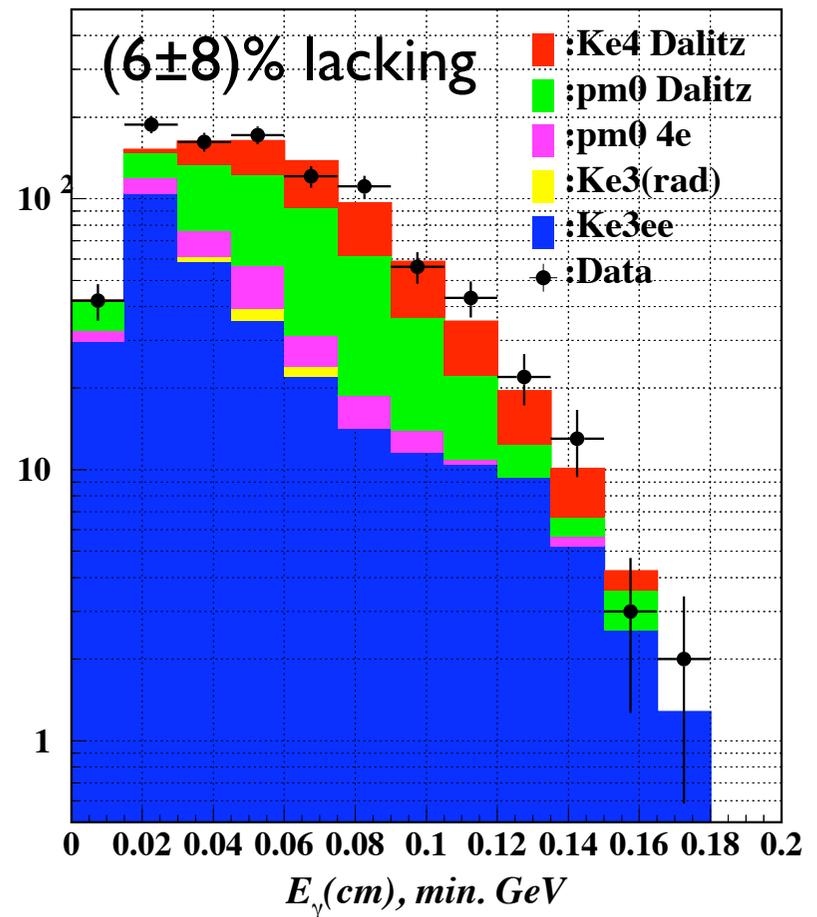
Correction factor should be  
 $1.7 \rightarrow 2.4$  for photon events  
(blue stripe area)  $\times$  (2.4 - 1) = (white area)

# $E_\gamma$ (cm)

## Last meeting



## New result



Systematic uncertainty on the branching fraction  
+1.00% → ± 0.16%

# Uncertainty from Geant :Pion loss in TRD

not yet

# Systematic uncertainties of Branching fraction(%)

Source of uncertainty	(%)
Photon det. in norm.	+0.83
vertex $\chi^2$	$\pm 0.70$
$\pi$ loss in TRD	$\pm 0.47$
$E_K$ distribution	- 0.35
Cut-off $M_{ee}$	- 0.18
Radiative corrections	$\pm 0.16$
$e^\pm$ ineff. in E/p	$\pm 0.08$

Source of uncertainty	(%)
$e^\pm$ ineff. in TRD	$\pm 0.08$
$\pi^\pm$ ineff. in E/p	$\pm 0.03$
BG. $Ke3\gamma$	$\pm 0.07$
BG. $K_{+-0}$ Dalitz	$\pm 0.04$
MC stat. $Ke3ee$	$\pm 0.26$
MC stat. Norm.	$\pm 0.11$
MC stat. BG.	$\pm 0.09$

**Total  $+1.24$  - 1.01 (%)**

# $BR(Ke3ee)$

*Preliminary*

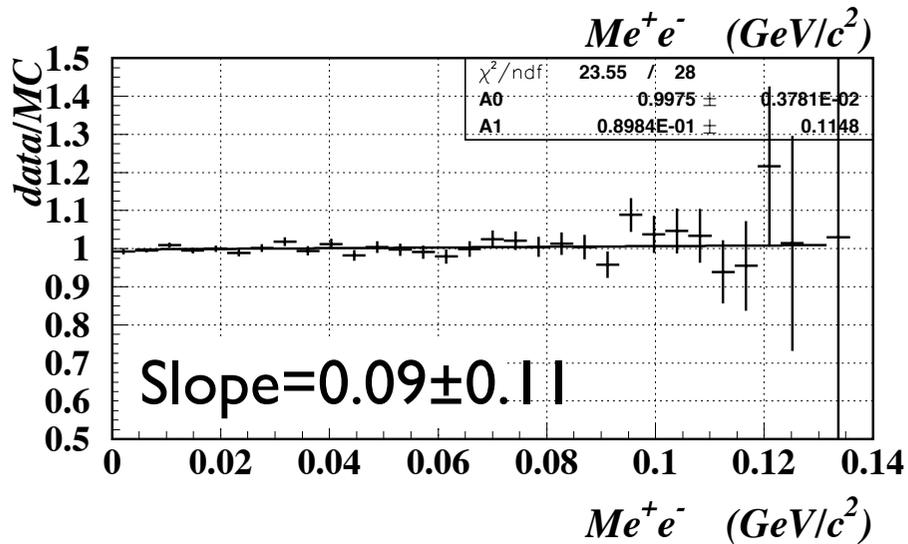
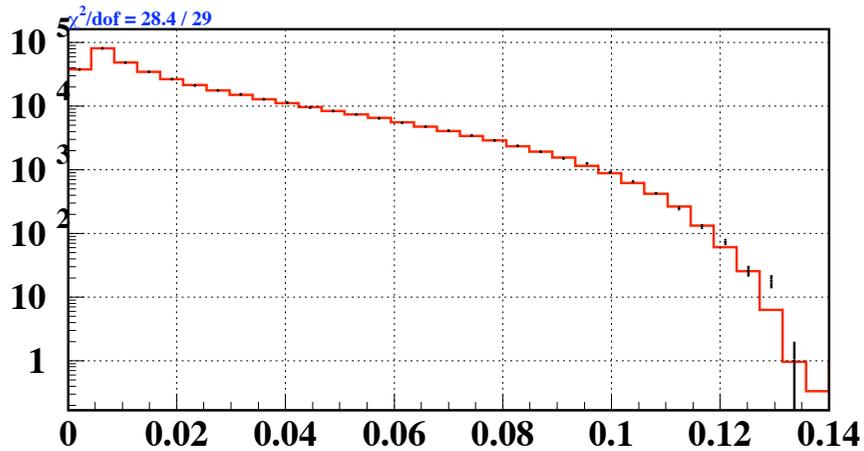
$BR(Ke3ee; Me^+e^- > 0.005 \text{ GeV}/c^2)$

$$= [1.848 \pm 0.014(\text{stat. signal}) \\ \pm 0.004(\text{stat. norm.}) \\ +0.023 \\ -0.019 \text{ (systematic)} \\ \pm 0.052(\text{external})] \times 10^{-5}$$

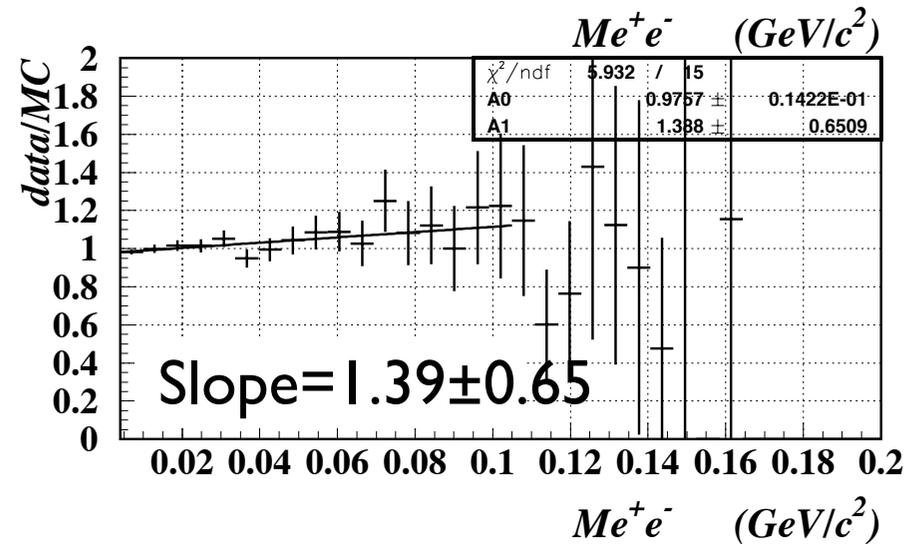
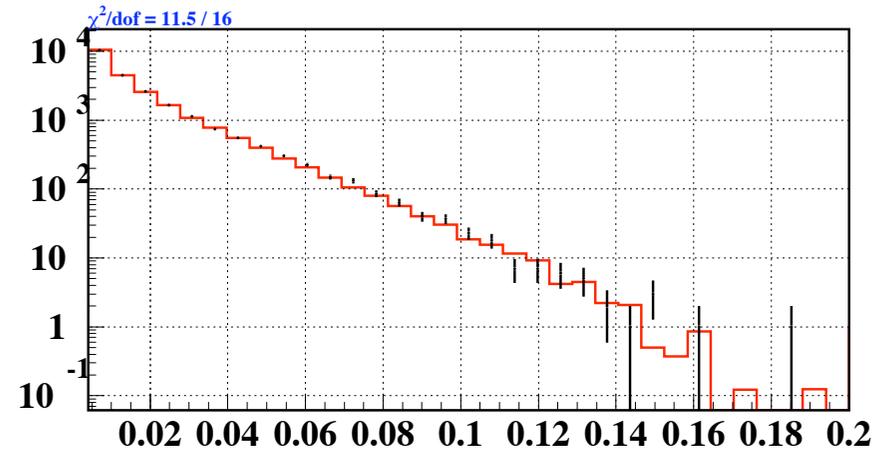
↓  
from  $BR(K_L \rightarrow \pi^+\pi^-\pi^0_D)$

# $Me^+e^-$

## Normalization mode



## Ke3ee



# Plan

- $BR[k\ell^3\ell\gamma]/BR[k\ell^3\ell]$
- $BR[k\ell^3\ell]/BR[k\ell^3]$
- Uncertainty from pion loss in TRD
- Uncertainty from virtual radiation.
- Thesis

# $BR(Ke3ee)$ c.f. last meeting

*Preliminary*

$BR(Ke3ee; M_{e^+e^-} > 0.005 \text{ GeV}/c^2)$

$$= [1.606 \pm 0.012 (\text{stat. signal}) \\ \pm 0.003 (\text{stat. norm.}) \\ +0.026 \\ -0.016 (\text{systematic}) \\ \pm 0.045 (\text{external})] \times 10^{-5}$$

↓  
from  $BR(K_L \rightarrow \pi^+ \pi^- \pi^0_D)$